

SEQUENCE LISTING

<110> Lin, Yi-Jyun
 Benzer, Seymour
 California Institute of Technology

<120> METHUSELAH GENE, COMPOSITIONS AND
 METHODS OF USE

<130> 06618/343001

<140> 09/370,098

<141> 1999-08-06

<150> 60/095,826

<151> 1998-08-07

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<170> FastSEQ for Windows Version 4.0

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<212> DNA

<213> Drosophila Melanogaster

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aaaaaagca taa atg aaa act ctt ttg gtt ctt cgg ata tca act gtc ata	171

* Met Lys Thr Leu Leu Val Leu Arg Ile Ser Thr Val Ile

1

5

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ctt gtt gtg ctg gtt att caa aaa tca tat gca gac att ctc gaa tgc	219
Leu Val Val Leu Val Ile Gln Lys Ser Tyr Ala Asp Ile Leu Glu Cys	
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gat tat ttc gac act gtc gat att tcg gca gct caa aaa cta cag aat	267
Asp Tyr Phe Asp Thr Val Asp Ile Ser Ala Ala Gln Lys Leu Gln Asn	
30 35 40 45	

gga tcg tac tta ttt gag ggg ttg ctc gtt ccg gcc att ttg acg gga	315
Gly Ser Tyr Leu Phe Glu Gly Leu Leu Val Pro Ala Ile Leu Thr Gly	
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gaa tat gac ttt agg att ctc ccg gac gac tcg aag cag aag gtg gct	363
Glu Tyr Asp Phe Arg Ile Leu Pro Asp Ser Lys Gln Lys Val Ala	
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cgt cac ata aga gga tgt gtg tgc aag ctg aag ccc tgt gtc aga ttt	411
Arg His Ile Arg Gly Cys Val Cys Lys Leu Lys Pro Cys Val Arg Phe	
80 85 90	

tgc tgc cct cac gac cat atc atg gat aat ggt gtc tgc tac gac aac	459
Cys Cys Pro His Asp His Ile Met Asp Asn Gly Val Cys Tyr Asp Asn	
95 100 105	

097098-06

atg tcc gac gag gag ctg gct gaa ctc gat ccc ttc ctt aat gtg act	507
Met Ser Asp Glu Glu Leu Ala Glu Leu Asp Pro Phe Leu Asn Val Thr	
110 115 120 125	
ctt gac gac ggg tcg gtg tcc cgc aga cac ttt aaa aac gaa cta atc	555
Leu Asp Asp Gly Ser Val Ser Arg Arg His Phe Lys Asn Glu Leu Ile	
130 135 140	
gtc cag tgg gac cta ccg atg ccg tgt gac gga atg ttc tac cta gac	603
Val Gln Trp Asp Leu Pro Met Pro Cys Asp Gly Met Phe Tyr Leu Asp	
145 150 155	
aac cgc gaa gaa cag gat aag tac acg ttg ttc gag aac gga act ttc	651
Asn Arg Glu Glu Gln Asp Lys Tyr Thr Leu Phe Glu Asn Gly Thr Phe	
160 165 170	
ttt cgc cac ttt gac cgt gtg act ctt cgc aag cgg gaa tac tgc ctt	699
Phe Arg His Phe Asp Arg Val Thr Leu Arg Lys Arg Glu Tyr Cys Leu	
175 180 185	
cag cat ctt aca ttc gca gat ggt aat gct acg tct att cga att gca	747
Gln His Leu Thr Phe Ala Asp Gly Asn Ala Thr Ser Ile Arg Ile Ala	
190 195 200 205	
cct cac aac tgt ttg ata gtg cca tca att acc ggt cag acg gtt gtg	795
Pro His Asn Cys Leu Ile Val Pro Ser Ile Thr Gly Gln Thr Val Val	
210 215 220	
atg atc tct tcg ctg ata tgc atg gtt cta acg atc gcc gta tac ctc	843
Met Ile Ser Ser Leu Ile Cys Met Val Leu Thr Ile Ala Val Tyr Leu	
225 230 235	
ttc gtc aag aaa cta caa aac ttg cat gga aaa tgc ttc atc tgc tac	891
Phe Val Lys Lys Leu Gln Asn Leu His Gly Lys Cys Phe Ile Cys Tyr	
240 245 250	
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Met Val Cys Leu Phe Met Gly Tyr Leu Phe Leu Leu Leu Asp Leu Trp	
255 260 265	
cag ata tcc att agc ttt tgc aaa cca gca ggt ttt ctg ggt tac ttc	987
Gln Ile Ser Ile Ser Phe Cys Lys Pro Ala Gly Phe Leu Gly Tyr Phe	
270 275 280 285	
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Phe Val Met Ala Ala Phe Phe Trp Leu Ser Val Ile Ser Leu His Leu	
290 295 300	
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Trp Asn Thr Phe Arg Gly Ser Ser His Lys Ala Asn Arg Phe Leu Phe	
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gag cat cgg ttt ctg gcc tac aat acc tat gct tgg ggc atg gcg gtg	1131
Glu His Arg Phe Leu Ala Tyr Asn Thr Tyr Ala Trp Gly Met Ala Val	
320 325 330	
gtc ctg aca gga att acc gtt ctg gcc gat aac atc gtg gaa aac cag	1179
Val Leu Thr Gly Ile Thr Val Leu Ala Asp Asn Ile Val Glu Asn Gln	
335 340 345	

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 Asp Trp Asn Pro Arg Val Gly His Glu Gly His Cys Trp Ile Tyr Thr 365
 350 355 360

caa gcc tgg tca gcc atg ctc tac ttt tac ggt cca atg gta ttt ctt 1275
 Gln Ala Trp Ser Ala Met Leu Tyr Phe Tyr Gly Pro Met Val Phe Leu 380
 370 375

att gcc ttt aac ata acc atg ttc atc ctg acg gct aag cgt ata tta 1323
 Ile Ala Phe Asn Ile Thr Met Phe Ile Leu Thr Ala Lys Arg Ile Leu 395
 385 390

gga gtg aag aag gac att cag aac ttt gcg cac agg caa gag aga aag 1371
 Gly Val Lys Lys Asp Ile Gln Asn Phe Ala His Arg Gln Glu Arg Lys 410
 400 405

cag aag ctg aac tcc gac aaa cag act tac acc ttc ttc cta cgg ctc 1419
 Gln Lys Leu Asn Ser Asp Lys Gln Thr Tyr Thr Phe Phe Leu Arg Leu 425
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ttc atc att atg gga ttg tcc tgg agc ttg gag ata ggc tcc tac ttt 1467
 Phe Ile Ile Met Gly Leu Ser Trp Ser Leu Glu Ile Gly Ser Tyr Phe 445
 430 435 440

tcg caa tcc aac caa act tgg gcc aac gtc ttt ctg gtg gct gac tat 1515
 Ser Gln Ser Asn Gln Thr Trp Ala Asn Val Phe Leu Val Ala Asp Tyr 460
 450 455

tta aat tgg tct caa gga atc atc ata ttt ata ctg ttc gtt ctg aag 1563
 Leu Asn Trp Ser Gln Gly Ile Ile Ile Phe Ile Leu Phe Val Leu Lys 475
 465 470

cgc agc acg tgg aga ctc ttg cag gag agc att agg ggg gag ggt gag 1611
 Arg Ser Thr Trp Arg Leu Leu Gln Glu Ser Ile Arg Gly Glu Gly Glu 490
 480 485

gag gta aac aac agt gag gaa gag att tcg cta gaa aac acg acg aca 1659
 Glu Val Asn Asn Ser Glu Glu Glu Ile Ser Leu Glu Asn Thr Thr Thr 505
 495 500

cga aat gtc cta tta tag ga accatcctaa atccacgagg agtgtcattt 1709
 Arg Asn Val Leu Leu *
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ctaacagatc tatggcaagt cgtattaccg tgggaacaac tcctaaaaat aaagcacgga 1769
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 cataaataac ggtttctgta tatcactttt cttaaaacta ttcaactaac tcagatggat 1889
 ttaacaccgt ttattgaaca taagatgttt ttttaacattt gaaataaaaa ataatactgc 1949
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 <213> Drosophila Melanogaster

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 Asp Thr Val Asp Ile Ser Ala Ala Gln Lys Leu Gln Asn Gly Ser Tyr

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Phe	Arg	Ile	Leu	Pro	Asp	Asp	Ser	Lys	Gln	Lys	Val	Ala	Arg	His	Ile	
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Arg	Gly	Cys	Val	Cys	Lys	Leu	Lys	Pro	Cys	Val	Arg	Phe	Cys	Cys	Pro	
				85					90					95		
His	Asp	His	Ile	Met	Asp	Asn	Gly	Val	Cys	Tyr	Asp	Asn	Met	Ser	Asp	
			100					105					110			
Glu	Glu	Leu	Ala	Glu	Leu	Asp	Pro	Phe	Leu	Asn	Val	Thr	Leu	Asp	Asp	
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Gly	Ser	Val	Ser	Arg	Arg	His	Phe	Lys	Asn	Glu	Leu	Ile	Val	Gln	Trp	
						135					140					
Asp	Leu	Pro	Met	Pro	Cys	Asp	Gly	Met	Phe	Tyr	Leu	Asp	Asn	Arg	Glu	
145					150					155					160	
Glu	Gln	Asp	Lys	Tyr	Thr	Leu	Phe	Glu	Asn	Gly	Thr	Phe	Phe	Arg	His	
				165					170					175		
Phe	Asp	Arg	Val	Thr	Leu	Arg	Lys	Arg	Glu	Tyr	Cys	Leu	Gln	His	Leu	
			180					185					190			
Thr	Phe	Ala	Asp	Gly	Asn	Ala	Thr	Ser	Ile	Arg	Ile	Ala	Pro	His	Asn	
			195				200					205				
Cys	Leu	Ile	Val	Pro	Ser	Ile	Thr	Gly	Gln	Thr	Val	Val	Met	Ile	Ser	
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Ser	Leu	Ile	Cys	Met	Val	Leu	Thr	Ile	Ala	Val	Tyr	Leu	Phe	Val	Lys	
225				230						235					240	
Lys	Leu	Gln	Asn	Leu	His	Gly	Lys	Cys	Phe	Ile	Cys	Tyr	Met	Val	Cys	
				245					250					255		
Leu	Phe	Met	Gly	Tyr	Leu	Phe	Leu	Leu	Leu	Asp	Leu	Trp	Gln	Ile	Ser	
			260					265					270			
Ile	Ser	Phe	Cys	Lys	Pro	Ala	Gly	Phe	Leu	Gly	Tyr	Phe	Phe	Val	Met	
		275					280					285				
Ala	Ala	Phe	Phe	Trp	Leu	Ser	Val	Ile	Ser	Leu	His	Leu	Trp	Asn	Thr	
						295					300					
Phe	Arg	Gly	Ser	Ser	His	Lys	Ala	Asn	Arg	Phe	Leu	Phe	Glu	His	Arg	
305					310					315					320	
Phe	Leu	Ala	Tyr	Asn	Thr	Tyr	Ala	Trp	Gly	Met	Ala	Val	Val	Leu	Thr	
				325					330					335		
Gly	Ile	Thr	Val	Leu	Ala	Asp	Asn	Ile	Val	Glu	Asn	Gln	Asp	Trp	Asn	
			340					345					350			
Pro	Arg	Val	Gly	His	Glu	Gly	His	Cys	Trp	Ile	Tyr	Thr	Gln	Ala	Trp	
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Ser	Ala	Met	Leu	Tyr	Phe	Tyr	Gly	Pro	Met	Val	Phe	Leu	Ile	Ala	Phe</	

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 Lys Lys Leu Gln Asn Leu His Gly Lys Cys Phe Ile Cys Tyr Met Val
 35 40 45
 Cys Leu Phe Met Gly Tyr Leu Phe Leu Leu Leu Asp Leu Trp Gln Ile
 50 55 60
 Ser Ile Ser Phe Cys Lys Pro Ala Gly Phe Leu Gly Tyr Phe Phe Val
 65 70 75 80
 Met Ala Ala Phe Phe Trp Leu Ser Val Ile Ser Leu His Leu Trp Asn
 85 90 95
 Thr Phe Arg Gly Ser Ser His Lys Ala Asn Arg Phe Leu Phe Glu His
 100 105 110
 Arg Phe Leu Ala Tyr Asn Thr Tyr Ala Trp Gly Met Ala Val Val Leu
 115 120 125
 Thr Gly Ile Thr Val Leu Ala Asp Asn Ile Val Glu Asn Gln Asp Trp
 130 135 140
 Asn Pro Arg Val Gly His Glu Gly His Cys Trp Ile Tyr Thr Gln Ala
 145 150 155 160
 Trp Ser Ala Met Leu Tyr Phe Tyr Gly Pro Met Val Phe Leu Ile Ala
 165 170 175
 Phe Asn Ile Thr Met Phe Ile Leu Thr Ala Lys Arg Ile Leu Gly Val
 180 185 190
 Lys Lys Asp Ile Gln Asn Phe Ala His Arg Gln Glu Arg Lys Gln Lys
 195 200 205
 Leu Asn Ser Asp Lys Gln Thr Tyr Thr Phe Phe Leu Arg Leu Phe Ile
 210 215 220
 Ile Met Gly Leu Ser Trp Ser Leu Glu Ile Gly Ser Tyr Phe Ser Gln
 225 230 235 240
 Ser Asn Gln Thr Trp Ala Asn Val Phe Leu Val Ala Asp Tyr Leu Asn
 245 250 255
 Trp Ser Gln Gly Ile Ile Ile Phe Ile Leu Phe Val Leu
 260 265

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 Leu Phe Val Gly Ser Thr Ile Phe Leu Ala Gly Ile Glu Asn Glu Gly
 35 40 45
 Gly Gln Val Gly Leu Arg Cys Arg Leu Val Ala Gly Leu Leu His Tyr
 50 55 60
 Cys Gly Leu Ala Ala Gly Cys Trp Met Ser Leu Glu Gly Leu Glu Leu
 65 70 75 80
 Tyr Phe Leu Val Val Arg Val Phe Gln Gly Gln Gly Leu Ser Thr Arg
 85 90 95
 Trp Leu Cys Leu Ile Gly Tyr Gly Val Pro Leu Leu Ile Val Gly Val

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100 105 110
 Ser Ala Ala Ile Tyr Ser Lys Gly Tyr Gly Arg Pro Arg Tyr Cys Trp
 115 120 125
 Leu Asp Phe Glu Gln Gly Phe Leu Trp Ser Phe Leu Gly Pro Val Thr
 130 135 140
 Phe Ile Ile Leu Cys Asn Ala Val Ile Phe Val Thr Thr Val Trp Lys
 145 150 155 160
 Leu Thr Gln Lys Phe Ser Glu Ile Asn Pro Asp Met Lys Lys Leu Lys
 165 170 175
 Lys Ala Arg Ala Leu Thr Ile Thr Ala Ile Ala Gln Leu Phe Leu Leu
 180 185 190
 Gly Cys Thr Trp Val Phe Gly Leu Phe Ile Phe Asp Asp Arg Ser Leu
 195 200 205
 Val Leu Thr Tyr Val Phe Thr Ile Leu Asn Cys Leu Gln Gly Ala Phe
 210 215 220
 Leu Tyr Leu Leu His Cys Leu
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 <212> PRT
 <213> Rattus norvegicus

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 Leu Gln Thr Asp Arg Asn Thr Ile His Lys Asn Leu Cys Ile Asn Leu
 35 40 45
 Phe Leu Ala Glu Leu Leu Phe Leu Val Gly Ile Asp Lys Thr Gln Tyr
 50 55 60
 Glu Val Ala Cys Pro Ile Phe Ala Gly Leu Leu His Tyr Phe Phe Leu
 65 70 75 80
 Ala Ala Phe Ser Trp Leu Cys Leu Glu Gly Val His Leu Tyr Leu Leu
 85 90 95
 Leu Val Glu Val Phe Glu Ser Glu Tyr Ser Arg Thr Lys Tyr Tyr Tyr
 100 105 110
 Leu Gly Gly Tyr Cys Phe Pro Ala Leu Val Val Gly Ile Ala Ala Ala
 115 120 125
 Ile Asp Tyr Arg Ser Tyr Gly Thr Glu Lys Ala Cys Trp Leu Arg Val
 130 135 140
 Asp Asn Tyr Phe Ile Trp Ser Phe Ile Gly Pro Val Ser Phe Val Ile
 145 150 155 160
 Val Val Asn Leu Val Phe Leu Met Val Thr Leu His Lys Met Ile Arg
 165 170 175
 Ser Ser Ser Val Leu Lys Pro Asp Ser Ser Arg Leu Asp Asn Ile Lys
 180 185 190
 Ser Trp Ala Leu Gly Ala Ile Ala Leu Leu Phe Leu Leu Gly Leu Thr
 195 200 205
 Trp Ala Phe Gly Leu Leu Phe Ile Asn Lys Glu Ser Val Val Met Ala
 210 215 220
 Tyr Leu Phe Thr Thr Phe Asn Ala Phe Gln Gly Val Phe Ile Phe Val
 225 230 235 240

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 <213> Mus musculus

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Cys	Arg	Ala	Val	Gln	Asn	His	Asn	Thr	Tyr	Met	His	Leu	His	Leu	Cys
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Val	Cys	Leu	Phe	Leu	Ala	Lys	Ile	Leu	Phe	Leu	Thr	Gly	Ile	Asp	Lys
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Thr	Asp	Asn	Gln	Thr	Ala	Cys	Ala	Ile	Ile	Ala	Gly	Phe	Leu	His	Tyr
	50					55					60				
Leu	Phe	Leu	Ala	Cys	Phe	Trp	Met	Leu	Val	Glu	Ala	Val	Met	Leu	
65					70				75					80	
Phe	Met	Val	Arg	Asn	Leu	Lys	Val	Val	Asn	Tyr	Phe	Ser	Ser	Arg	Asn
				85					90					95	
Ile	Lys	Met	Leu	His	Leu	Cys	Ala	Phe	Gly	Tyr	Gly	Leu	Pro	Val	Leu
			100					105						110	
Val	Val	Ile	Ile	Ser	Ala	Ser	Val	Gln	Pro	Arg	Gly	Tyr	Gly	Met	His
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Asn	Arg	Cys	Trp	Leu	Asn	Thr	Glu	Thr	Gly	Phe	Ile	Trp	Ser	Phe	Leu
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Gly	Pro	Val	Cys	Met	Ile	Ile	Thr	Ile	Met	Ser	Val	Leu	Leu	Ala	Trp
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Thr	Leu	Trp	Val	Leu	Arg	Gln	Lys	Leu	Cys	Ser	Val	Ser	Ser	Glu	Val
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Ser	Lys	Leu	Lys	Asp	Thr	Arg	Leu	Leu	Thr	Phe	Lys	Ala	Ile	Ala	Gln
			180				185						190		
Ile	Phe	Ile	Leu	Gly	Cys	Ser	Trp	Val	Leu	Gly	Ile	Phe	Gln	Ile	Gly
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Pro	Leu	Ala	Ser	Ile	Met	Ala	Tyr	Leu	Phe	Thr	Ile	Ile	Asn	Ser	Leu
	210					215					220				
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225					230					235					

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